Name: _____ Lab section: _____

CRSS(FORS) 3060 - Soils and Hydrology - Exam 3

1. (3 points) Lake Lanier (near Gainesville, GA) holds approximately 1,907,000 acre-feet of water when full. What is the average residence time of water in the reservoir if the flow into the lake is 2,020 cfs? HINT: Use 1 cfs = 2 acre-feet per day

2. (3 points) What is the average reservoir depth if the surface area of the lake is 60 mi^2? HINT: Use 1 mi^2 = 640 acres

3. (3 points) What is the average inflow expressed as a depth (inches/yr) over the 1,040 mi^2 watershed upstream of the reservoir?

4. (3 points) Fill in the blanks using the correct symbols:

	Source:		Air Mass:
mP	North Atlantic Ocean (example)	c	Continental
_____	Gulf of Mexico	m	Maritime
_____	Canada	T	Tropical
_____	Arizona	P	Polar

5. (3 points) Which kind of front yields precipitation with low intensity and long duration?

6. (3 points) Why is the wet air lapse rate less than the dry air lapse rate?

7. (3 points) Use the dry air lapse rate to find the temperature on the coast if it's 45°F at 1000 ft.

8. (3 points) What rainfall mechanism likely caused the record rainfall of 12 inches in 42 minutes in Holt, Missouri, on June 22, 1947?

9. (3 points) Which reason most likely limits water availability to plants in soil:

   - o The low permeability of dry soils reduces the ability of water to move toward roots
   - o Plant roots die in dry soil
   - o Plant roots can not overcome surface tension forces in the soil
   - o There is no water left in dry soils

10. (3 points) Circle one: A [xeriphyte / phreatophyte] is generally found in wetlands.

11. (3 points) Check one: What reason causes the majority of water use in plants:

    o Photosynthesis requires water for generating sugars

    o Plant growth requires nutrients carried in the water

    o Solar radiation on plant surfaces requires evaporative cooling

    o Water is lost as a by-product of gas exchange through stomata

12. (10 points) Complete the following table. Show the equivalent pore size using the equation $r = 1.5/p$ where r is the pore radius in micrometers, μm, and p is the pressure in bars.

Soil Tension (bars)	Water Content (name)	Pore Radius (μm)	Relative Humidity (%)
0.001			
0.1			
15			
1,000			
10,000			

13. (5 points) Rank (from highest to lowest) the observed evaporation rate from five evaporation pans filled with water that are placed in the following areas.

    _____ Green grass, no shade

    _____ In the middle of a lake, no shade

    _____ Bare concrete, no shade

    _____ Deep, dark forest

    _____ Bare soil, no shade

14. (3 points) [Mark any] The dewpoint temperature:

    o occurs when the relative humidity is 100%.

    o is the temperature when the actual vapor pressure equals the saturation vapor pressure.

    o occurs only in the early morning hours.

    o is found at the bottom of clouds.

15. (3 points) What is the volume of a soil sample, in cm^3, collected in a metal ring (diameter = 3", height = 3")?

16. (3 points) What is the bulk density, g/cm^3, of the soil if the oven-dry weight is 20.8 ounces?

17. (3 points) What is the porosity of the soil?

18. (12 points) Complete the following table using the above information.

	Soil Condition				
	Saturated	Field Capacity	Wilting Point	Air Dry	Oven Dry
soil mass, g		710	660	635	
water mass, g					
θ_g					
θ_v					

19. (3 points) What is the maximum depth of available water (in inches) if the soil is 6 inches deep?

20. (8 points) Soil pressures were measured in a soil profile. Complete the following table:

Elevation (cm)	Pressure (cm)	Total Head (cm)	Gradient (cm/cm)
100	-80		
80	-50		
60	-20		
40	-10		
20	0		
0	20		

21. (3 points) At what depth does the flow reverse direction?

22. (3 points) At what depth is the water table?

23. (8 points) Complete the following table. Assume $S = 4$ inches and $K_c = 0.70$

	Day						
	1	2	3	4	5	6	7
F							
K_s							
PET	0.20	0.25	0.10	0.30	0.40	0.20	0.25
AET							
F'							
P	0.05	0.00	3.20	0.00	0.00	0.20	0.00
F''							
Q							
F'''							

24. (3 points) True - False: An artesian aquifer is found in the unsaturated zone.

25. (3 points) True - False: The water table separates confined from unconfined aquifers.

26. (3 points) True - False: Seeps occur when the water table rises above the ground surface.

27. (2 points extra credit each) Two wells are located one-mile apart, one upstream of another. The water levels drop 10 feet between the two wells. The hydraulic conductivity of the aquifer is estimated to be 10 feet per day. The aquifer is estimated to be 100 feet thick.

    (a) What is the hydraulic gradient between the two wells?

    (b) What is the flux in the aquifer between the two wells?

    (c) What is the total flow per unit width of aquifer, in units of cubic feet per day per mile of aquifer width ($ft^3/day/mile$)?